disklike formation, probably of spray but possibly including leaves and dead weeds from the bridge roadway. The cylindrical formation was apparently five times the diameter of the spout which reached its center, and about 40 yards high as compared with the tops of trees on the opposite shore of the bay. This phase continued until 9:28 a. m., when the shore line was reached.

Mr. Dann E. Jett, who heard a roaring noise and observed the phenomenon from a distance of about 200 feet east of its path when it reached the Cochrane Bridge roadway, which is about 150 feet in width and 5 feet higher than the water level, estimated the spout was fully 50 feet in diameter. He saw it sustain at a height of about 10 feet several pieces of 3-inch pine lumber 18 feet in length and 6 to 10 inches in width, causing them to rotate counter-clockwise in a nearly horizontal plane before dropping them a few feet from their original location on the south side of the roadway.

Cloudy weather prevailed after 6:10 a. m., the sky being overcast with lower clouds after 8:20 a. m., light rain fell from 8:10 a. m. to 9:20 a. m. and from 9:40 a. m. to 10:55 a. m. The clouds near the waterspout apparently moved in the same direction as the spout, but subsequently appeared to spread eastwardly. Barometric pressure was nearly stationary rising from 30.08 inches at 7 a. m. to 30.09 inches at 10 a. m. The wind movement until 11 a. m. averaged 3 miles an hour with a maximum speed of 9 miles an hour during about 8:20 a. m. The direction was from the west. A thunderstorm coming from the east occurred after the waterspout. The first thunder was heard at 9:56 a. m., the loudest at 10:21 a. m., and the last at 10:43 a. m.

The bearings and the angular altitude of the spout were taken from the Weather Bureau office window and, used with data secured from Mr. Jett and other spectators, it was practicable to plot the path on a map and determine dimensions. The spout moved 3 miles at 12 miles an hour in a direction north 29½° east from the point first noticed, 6,270 yards from the Weather Bureau office, and it had traveled 5.2 miles in the same direction before reaching this location. Its height was 937 yards and its approximate diameter as determined by comparison with a bridge tower was 35.6 feet at the lower end and 71 feet at the upper end, subsequently changing to a uniform diameter of 53 feet.

L. H. NICHOLS ON METEOROLOGICAL AND FOREST-FIRE HAZARD CONDITIONS IN THE PROVINCE OF QUEBEC[1]

By M. F. BURRILL

This paper is a report by Professor Nichols covering an investigation carried out in the summer of 1928 under the auspices of the Quebec Forest Industries Association. The objects of the investigation were:

(*a*) The making of an estimate of fire hazard on reports furnished by the Meteorological Bureau of Toronto and by the aid of any experiments which should suggest themselves * * *

(*b*) To study the possibility of developing and improving "weather forecasts" and the determining of fire hazard.

(*c*) To study the useful lines along which research work could be carried out in connection with forest fires—collection of statistics, etc.

Professor Nichols felt that he should not accept without verification any of the work done by Americans because "in general it seemed certain that conditions controlling forest fires in the Province of Quebec would be found to vary widely from those obtaining in the Western States on account of differences of climate, forest types, and colonization policies," and also because representative pamphlets and papers on the subject "revealed a certain vagueness of thinking and a very considerable repetition of well-established dogmas which were applicable on the whole to sections of the western half of the United States and to isolated parts of the New England States."

The "attack on the problem was directed along three main lines:

"(*a*) A visit to each main area and humidity station.

"(*b*) Physical experiments in the forest to assist in drawing a conclusion as to 'fire hazard.'

"(*c*) A study of the precipitation of past years at Montreal and Quebec to see if there was any traceable law in occurrences of years of deficient precipitation and a study of the weather of the last 'fire year.'"

Of the 11 humidity stations, 8 appear to have records representative of the surrounding country. Considerable difficulty has been experienced in securing complete, carefully taken records. "After a careful study of the humidity records," the author "failed to find any marked differences among them."

A special study at Caribou Depot (southern St. Lawrence) and at Mistassini (Laurentian) "found out that the winds from northeast, south, southeast, south, and southwest, were the most probable origin of moisture. The winds from the west, northwest, and north were lacking in moisture as a rule.

Much remains to be done in local and district forecasting. Little effort was made during the summer to check the accuracy of district forecasts from the Toronto office. The present fire forecast areas are: (1) The Ottawa Valley; (2) the St. Maurice Valley, Lake St. John; (3) the Laurentian or North Shore; (4) the southern St. Lawrence, including Gaspe. It is suggested that a new forecast area be established covering the territory from La Tuque to the Ontario line and northward.

To clear up all the vague notions of fire "hazard" Professor Nichols had confined the use of the term to "*the conditions of moisture content and inflammability of the dead forest materials which carry fire and spread it.*" It is true that—

graphs have been produced showing almost perfect correlation between fires observed and low relative humidities, but since we are in this case dealing with human intelligence the results have little more value than to prove conclusively that settlers and colonists know when it is a dry day and set their fires accordingly. There is some correlation also between fires in the bush and low relative humidity, but there are many occasions when there was low relative humidity and no fires so that we see that we must be reckoning with other factors.

To determine the other factors Professor Nichols experimented in the bush. Doubtful of the accuracy of duff hygrometers, he cut out pieces of the forest floor 18 by 12 by 1 inches, put these into wire letter trays, replaced them and weighed them, apparently at intervals, with a spring balance. With the bone-dry weight calculated from the weight of a dried inch-thick sample, the water content was the excess over dry weight.

The weight determinations, compared with the readings of the meteorological station, formed the basis of informative graphs which have capabilities of yielding considerable information not otherwise conveniently obtainable and *not hitherto obtained* in this Province.

It was found, also by experiment, that 10 per cent moisture content was near the starting point of inflammability by contact with a blazing match. Therefore * * * bone-dry weight plus 10 per cent in the "danger line." Ten per cent of moisture content is associated in equilibrium with about 40 per cent relative humidity.

[1] Abstract of reprint from Pulp and Paper Magazine (Canada), Feb. 14, 1929. Quarto, 15 pp., including 4 plates.

"Fire years" are the result of long dry spells, rather than of deficient total rainfall. No approach to regular periodicity appears in the summer rainfall. In the matter of fire-weather forecasting Professor Nichols finds that the practical and ideal aspects do not coincide. Ideally, the forecasting should be done from a central office close to the forests and to the central weather bureau, by a full-time forecaster cognizant of the topography, forest types, and meteorological eccentricities of his district and of the idiosyncrasies of the receiving personnel, and without regard to the ordinary published weather forecasts. The forecast should include the general trend of the weather for as long a period as possible and a special type of forecast concerning the minimum humidities to be expected for the next two days whenever a hazard is expected. Detailed indications of local winds and of unequal distribution of rainfall in the district should be included.

Ignorance of meteorology, lack of understanding of "hazard," lack of funds for extension of Meteorological Bureau and the opposition of that bureau to the establishment of local forecast offices, absence of competent forecasters for the work, and the youth of the problem leave three alternatives:

(1) Have a man from the Meteorological Service at Toronto spend the next summer in becoming thoroughly familiar with forest-protection work, and in continuing Professor Nichols' experiments.

(2) Employ a physicist temporarily for the summer of 1929 to conduct the "hazard" work only, with assistance.

(3) Leave existing arrangements in force to be tested in next fire season.

Three methods of forecasting minimum humidity are appended:

First method.—Multiply the change in relative humidity, which corresponds to a change of 1° of temperature, say at 7 a. m., by the difference in temperature of the average daily maximum and the average daily 7 a. m. temperature for a given week in any month and subtract this product from the average recorded relative humidity at 7 a. m.

Second method.—Divide the mean 7 p. m. or 6 p. m. vapor pressure by the saturation pressure corresponding to the expected maximum next day.

Third method.—By receiving a special 7 a. m. wire of the dew point, and consequently the vapor pressure, and dividing this by the saturation vapor pressure corresponding to the expected maximum temperature.

NOTES, ABSTRACTS, AND REVIEWS

Weather and the airplane.—Under the above title, a study of the model weather-reporting service over the California airway, by Edward H. Bowie, meteorologist in charge, United States Weather Bureau, San Francisco, has just been published by the Daniel Guggenheim Fund for the Promotion of Aeronautics (Inc.), 598 Madison Avenue, New York. It is a well-illustrated booklet of 28 pages that shows what service meteorology can give to aviation. A record of no accidents in a year owing to weather conditions is an enviable one, which can be ascribed only to the day and night watch over the weather, the excellence of the forecasts, the prompt communication of the weather information to the pilots and the willingness of the pilots to be guided by the weather conditions. How coastal routes are used when the interior is shrouded in fog, how the aviators are shown the levels of most helpful winds, how the height of the ceiling is observed hourly with searchlight by night and ballons by day; these are striking features of Major Bowie's report. On January 26, 1929, the pilot balloons showed a north-northwest wind of 96 miles per hour at 9,200 feet. The airplane pilot of the Western Air Express taking advantage of this wind established a new record of 1 hour and 59 minutes from Oakland airport to Vail Field, Los Angeles. On another date, the winds were southeasterly at low levels and northwesterly at high; northbound planes flew low and southbound ones high, both making good time.

The use of the airways weather service for automobile traffic, for drying fruit, rain forecasts, and for controlling forest fires is also indicated by the author.—*C. F. B.*

Chinese Institute of Meteorology.—A letter from Dr. Coching Chu, director, tells of the successful establishment of the Institute of Meteorology, a department of the National Research Institute of China formed by the Nationalist Government about a year ago. The purpose of the Institute of Meteorology is to collect climatological data, pursue meteorological researches, and fulfill the place and function of the national meteorological service of other countries.

For the 1928 data a quarterly meteorological bulletin is being published, and the first annual report is promised shortly. Beginning with 1929, the bulletin will be issued monthly and will contain the data for 20 or more stations. The bulletin for 1928 contains data only for Nanking, but this is in great detail, including tables and monthly graphs of the daily progress of temperature pressure and humidity and wind roses. Occasional monographs will be published, the first being a paper, Climatic Provinces of China, by Coching Chu, April, 1929, 11 pages, with 8 maps to follow later.

The institute is preparing weather charts for 6 a. m. daily, and broadcasting the weather conditions in Nanking at 11: 30 a. m. and 6: 30 p. m. through station XNK on wave-length 920 meters.—*C. F. B.*

Meteorological summary for Chile, June, 1929 (by J. Bustos Navarrette; Observatorio del Salto, Santiago, Chile).—In the central region of Chile the weather was not very rainy in this month. The most important periods of unsettled conditions and rain occurred in the first and last decades; the second decade was characterized by fine weather.

The depressions causing the most marked conditions of unsettled weather, rains, and storms were charted as follows: 4th to 6th, crossing the extreme south and manifesting its influence over a considerable extent of the country, with general rains and strong winds in the southern region; 19th to 20th, progressively affecting the southern, central, and northern zones, with general rains from Chiloe to Antofagasta, at which point there occurred a heavy storm; 22d to 25th, crossing the extreme south accompanied by rain and wind storms in the southern region; and, lastly, 26th to 30th, remaining stationary off Isla Mocha and prolonging until the end of the month the strong winds and rains in the south caused by the preceding depression.

In the region of Santiago the total precipitation was around 2.65 inches, in the region of Concepcion around 10.80 inches, while at Valdivia the amount exceeded 15.75 inches.—*Translated by W. W. R.*